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Contents

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Comparative study of non-obese & obese normal children feet using various external foot measurements and foot print

Shipra Bhatia*
Aparna Sarkar**
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Tanvi Gupta****

ABSTRACT

Objective: To compare the external foot measurements & foot print of non-obese& obese children **.Methods**:15 male and 15 female school children, without other health problems, who could be classified as overweight or obese according to international standard BMI cut-off points and hip-waist ratio on the basis of age and sex, were selected as experimental subjects. An additional 15 male and 15 females non-overweight children, matched for age, height, and sex to the overweight/obese children, were selected as non-overweight controls. To characterize the external structure and arch height of each child's feet, various foot dimensions , including foot length, normalized Instep length, Normalized Fibular Instep length, Normalized foot breadth, normalized navicular height truncated, and Staheli's Plantar Arch Index, were directly measured for the right foot of each child.**Results:** The external foot measurements namely instep length, fibular instep length and foot breadth were normalized using foot length. Student's T-test was used as Statistical test for data analysis and was compared with the age matched normal children. No significant difference was found between the groups. **Conclusion:** We concluded from this study that the external foot appearance of obese and non-obese children is similar and no significant difference is noted when compared using external foot measurements and footprints.

Keywords: Obesity, Plantar Arch, foot dimensions.

INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. As with obesity in adults, many different factors contribute to the rising rates of childhood obesity. Changing diet and decreasing physical activity are believed to be the two most important in causing the recent increase in the rates.The healthy BMI range varies with the age and sex of the child. Obesity in children and adolescents is defined as a BMI greater than the 95th percentile. Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, thus it is one of the most serious public health problems of the 21st century. Before the 20th century, obesity was rare; in 1997 the WHO formally recognized obesity as a global epidemic. There have been recent studies like, 'Obesity affects 12% of under 11s' (14th December, 2006) and 'Levels of obesity in children aged 2 to 10years rose from 9.9% to 13.4% between 1994 and 2004, according to health survey in England' (25th January, 2007).

In India, urbanization and modernization has been associated with obesity. In Northern India obesity was most prevalent in urban populations

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(male = 5.5%, female = 12.6%), followed by the urban slums (male = 1.9%, female = 7.2%).Obesity rates were the lowest in rural populations (male = 1.6%, female = 3.8%). Socioeconomic class also had an effect on the rate of obesity. Women of high socioeconomic class had rates of 10.4% as opposed to 0.9% in women of low socioeconomic class. With people moving into urban centers and wealth increasing, concerns about an obesity epidemic in India are growing.Various authors have suggested that excessive increases in weight bearing forces caused by obesity may negatively affect the lower limbs and feet.[1-3] Feet, as the body's base of support, continually endure often high ground reaction forces generated during activities of daily living. The component primarily responsible for absorbing and dissipating these forces in the feet is the longitudinal arch. Although this arch comprises bony articulations, ligaments and muscles, it is primarily the ligaments that support and stabilize the longitudinal arch, as well as acting as powerful energy-storing mechanisms.[4,5] When learning to walk, exercising walking we learn how to contract the muscles of the foot plant, and thereby generally the arch architecture of the plant itself organizes. The development of arches of foot takes place by the age of 5-8 years. Muscles provide secondary support by maintaining the arch during dynamic tasks. Ligaments rarely incur physiological fatigue and therefore offer a greater resistance to stress compared to muscles.[6] However, repeated excessive loading may stretch ligaments beyond their elastic limit, damaging soft tissues and increasing the risk of foot discomfort and subsequent development of foot pathologies.

Increased loading of the feet may be classified according to time-frame and described as temporary, short-term or long-term. A temporary loading effect occurs, for example, when carrying a backpack or wearing a weighted belt that temporarily increases body mass. The previous researches have revealed that one factor moderating foot shape and contact in prepubescent children is obesity. The overweight/ obese children had significantly larger contact areas between the total foot (TO), heel (M01), midfoot (M02) and forefoot (M03) and the ground when walking, compared to the non-overweight children. Do overweight and obesity affect dynamic plantar pressure distributions in preschool children? [7]In an attempt to better understand some of the musculoskeletal complications associated with childhood obesity, several studies have investigated the effects of obesity on foot structure and function. Although these investigations have repeatedly documented that obese primary school children typically display flatter feet relative to those of their leaner counterparts, the cause of this increased area of contact between the feet of obese children and the ground is unknown. It has been postulated that the flatter feet of obese children may be caused by the existence of a plantar fat pad underneath the midfoot region or hypertrophy of foot intrinsic muscles or can be some other reason also.

Riddiford-Harland et al [8] examined that the foot structure of obese and normal children. They concluded that excess body mass appeared to negatively affect the foot structure of prepubescent children whereby obese children as young as 8 years of age were displaying structural foot characteristics which may develop into problematic symptoms if excessive weight gain continued. It was also postulated that foot discomfort associated with higher plantar pressures caused by these structural changes in the obese foot may have hindered obese children from participating in physical activity and therefore warranted immediate further investigation. [8]Alternatively, it has been suggested that the flatter feet of obese children may be caused by a collapse of the medial longitudinal arch due to excessive loading of the feet as a result of continually bearing additional body mass. Such a structural collapse can develop into a potentially disabling problem in later life, as proper mechanics of the longitudinal arch are critical to normal foot function. This notion of a longitudinal arch collapse is purely speculative.

The previous studies were restricted to examining how obesity affect external characteristics of the plantar surface of the foot obtained from static weight-bearing footprints. It is, therefore, unknown whether obesity affects other parameters characterizing foot shape.This highlights the need to understand whether the appearance of flat foot shown in obese children actually flat foot or is it just an appearance. This study compares obese children feet with their normal non-obese counter parts of same age & gender group using various foot measurements

and footprints.The aim of the study was to compare the external foot measurements & foot print of non-obese & obese children at the same age group.

MATERIALS & METHODS

SUBJECTS

60 subjects, 30 non- obese & 30 obese male school children at the same age group were selected randomly on the basis of their BMI from DAV Public School, Vivek Vihar , New Delhi.

Research design: Experimental study

Sample design: Probability sampling

INCLUSION CRITERIA

1) Age Group – 10-12 yrs.
2) BMI (95 percentile)
3) Ready to participate.
4) Understand Hindi and English.

EXCLUSION CRITERIA

1) Symptoms of macro vascular (e.g. angina, stroke, peripheral vascular disease)
2) Neuromuscular disease
3) Any biomechanical abnormalities which affected their ability to walk.
4) Lower limb injuries
5) Frequent falls
6) Inner ear tube implant
7) Use of corrective devices or footwear e.g. Orthosis
8) Leg length discrepancy of one inch or greater.

EQUIPMENT USED

1. A measuring tape with centimeters scale was used for measuring the various external foot parameters

2. White chart paper, Pencil, ruler, Pen marker, Ink was used to take the foot print of the subjects.

3. Weighing scale & Stadiometer were used to find out the BMI of the subjects

PROCEDURE

The written consent was documented from each subject. The subjects were divided into two groups: Group 1 (obese) and Group 2(non-obese). To characterize the external structure and arch height of each child's feet, 5 foot dimensions were directly measured twice (three times if the values were not within 3 mm of each other) for the right foot of each child, while the children stood erect, eyes looking forward. Following were measured to the nearest 0.1 cm. To maximize reliability of the data, all the data from each of the 60 subjects was measured using the same apparatus and procedure.

OUTCOME MEASURES

Foot Length

It is the distance from the end point of foot to the longest to end. The child was made to stand and a point was marked at the heel and another point was marked at the tip of the longest toe. The distance was measured and recorded.

Normalized Instep Length

It is the ratio of a distance from the end point of foot to the inside middle foot point to foot length. To measure the instep length, the child was made to stand and a point was marked at the heel and another point was marked at the first metatarsophalangeal (MTP) joint. The distance was measured and recorded. Then the instep length was divided by foot length to get normalized instep length.

Normalized Fibular Instep Length

It is the ratio of a distance from the end point of foot to the outside middle foot point to foot length. To measure the fibular instep length the child was made to stand and a point was marked at the

heel and another point was marked at the fifth MTP joint. The distance was measured and recorded. Then the fibular instep length was divided by foot length to get normalized fibular instep length.

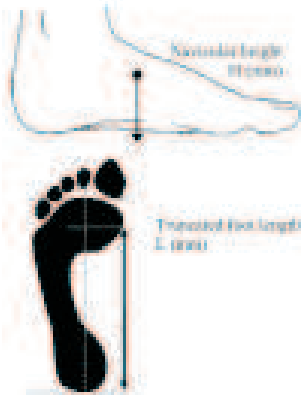
Normalized Foot Breadth

It is the ratio of a distance from the inside middle foot point to the outside middle foot point to foot length. To measure the normalized foot breadth the child was made to stand and a point was marked at the first MTP joint and another point was marked at the fifth MTP joint. The distance was measured and recorded. Then the foot breadth was divided by foot length to get normalized foot breadth.

Normalized navicular height truncated

It is the ratio of navicular height relative to the truncated length of the foot. Navicular height is the distance measured from the most medial prominence of the navicular tuberosity to the supporting surface. Foot length is truncated by measuring the perpendicular distance from the first metatarsophalangeal joint to the most posterior aspect of the heel, with a lower normalized navicular height ratio indicating a flatter foot.

Fig 1 & 2: Measurement of the Truncated length & Navicular height of the foot



Staheli's Plantar Arch Index

Footprints were recorded for each child's right and left foot. Each child slowly lowered one foot (of which the underside is inked) onto the chart paper and then stood motionless in an equal weight-bearing anatomical position for 2 seconds, while looking straight ahead, before quickly removing the foot. Two footprints of both the right and left feet were taken to obtain a permanent image of the plantar surface of the foot in contact with the ground during weight bearing.

The plantar arch index establishes a relationship between central and posterior regions of the footprint, and it is calculated as follows: a line is drawn tangent to the medial forefoot edge and at heel region. The mean point of this line is calculated. From this point, a perpendicular line is drawn crossing the footprint. The same procedure is repeated for heel tangency point. We thereby obtain the measurement of the support

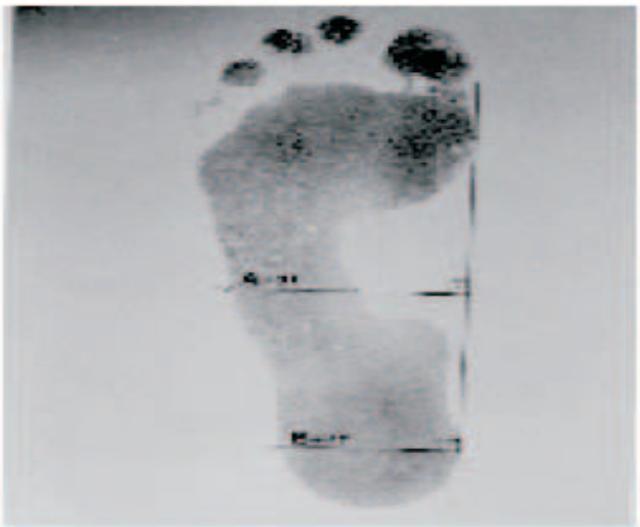


Figure 3- *Measurement of the width of the central region (A) and heel region (B) of the foot, in millimeters, on a footprint. The plantar arch index is obtained by dividing A value by B value.*

width of the central region to the foot (A) and of the heel region (B) in millimeters. The plantar arch index (PI) is obtained by dividing the A value by B value (PI = A/B).

STATISTICAL ANALYSIS

Student's t-test was used to compare the external foot measurements of obese & non-obese control groups. Values were presented as mean± standard deviation. Statistical significance level was set at $p< 0.05$.

RESULTS

The study was aimed at comparing the external foot structure of obese and non-obese children, aged 10-12 years. Two groups (obese and non-obese) were formed each comprising of 30 children. Matching was done on the basis of age (mean age 11yrs) and gender.

The external foot measurements namely instep length, fibular instep length and foot breadth were normalized using foot length. Student's t-test was used as statistical test for data analysis and was compared with the age matched normal non-obese children.

Age

In each group, 30 children were included with mean age of 11 years and standard deviation of 0.830.

Body Mass Index (BMI)

The obese children comparatively had a mean BMI :32 ± 0.894 kg/m2 and non-obese counter children had 19.76 ± 2.794 kg/m2 . The calculated t value was more than the critical value therefore it was significant.

Waist to hip ratio

The mean WHR for Group 1 (obese children) was 0.955± 0.034 and that for Group 2 (non-obese) was 0.826 ± 0.067 respectively. The p value was less than 0.05 and therefore it was significant.

Foot Length

The mean± SD for Group 1 was 8.777 ± 0.418 and for that of Group 2 was 8.67 ± 0.594. The calculated t value for foot length was lesser than the critical value($p> 0.05$) and therefore it was insignificant. Thus there is no significant difference in foot length of obese and non-obese children.

Normalized Instep length

The NIL for Group 1 was 0.738 ± 0.022 and for Group 2, it was 0.735 ± 0.028. The calculated t-value was 0.073 which was less than the critical value ($p>0.05$)and hence was insignificant and no difference was found in normalized instep length of obese children and their non-obese counter parts.

Normalized Fibular Instep length

The mean for Group 1 was 0.639 ±0.022 and that for Group 2 was 0.631±0.036. The calculated t value was 0.182. Hence the p value was greater than 0.05 and therefore it was insignificant. Hence there was no significant difference in NFIL between Group 1 and 2.

Normalized Foot Breadth

The values of NFB for Group 1 and Group 2 were 0.432 ± 0.027 and 0.440 ± 0.027 respectively. Since the calculated t-value was less than the critical value therefore the p-value was greater than 0.05 and hence there was no significant difference in NFB of obese and non-obese children aged 10-12 years.

Normalized Navicular Height

The mean±SD for Group 1 and Group 2 were 0.256± 0.041 and 0.274±0.047 respectively. The calculated t-value was 0.333 & p-value was greater than 0.05. This indicated that no significant difference was between normalized navicular height of obese and non-obese children at the mean age of 11 years.

Plantar Arch Index

The plantar arch index for group 1 and 2 with mean ±SD were 1.356 ± 0.087 and 1.408 ± 0.099

Table 1: Comparison of Age, BMI, Waist-Hip ratio & Foot measurements between obese & non-obese children

	Age	BMI	WHR	FL	NIL	NFIL	NFB	NNH	PAI
Group 1(Obese)	11 ± 0.83	32 ± 0.89	0.96±0.03	8.78±0.42	0.74±0.02	0.64±0.02	0.43±0.03	0.26±0.04	1.36±0.09
Group 2(non-obese)	11 ± 0.83	19.76±2.79	0.83±0.07	8.67 ± 0.59	0.74±0.03	0.63±0.04	0.44±0.03	0.27±0.05	1.41±0.10
t-Test	NS	34.87	2.22	0.58	0.07	0.18	0.19	0.33	0.66
p value	> 0.05	< 0.05	< 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

Fig.1: Shows comparison of NIL, NFIL, NFB & NNH between obese & non-obese children

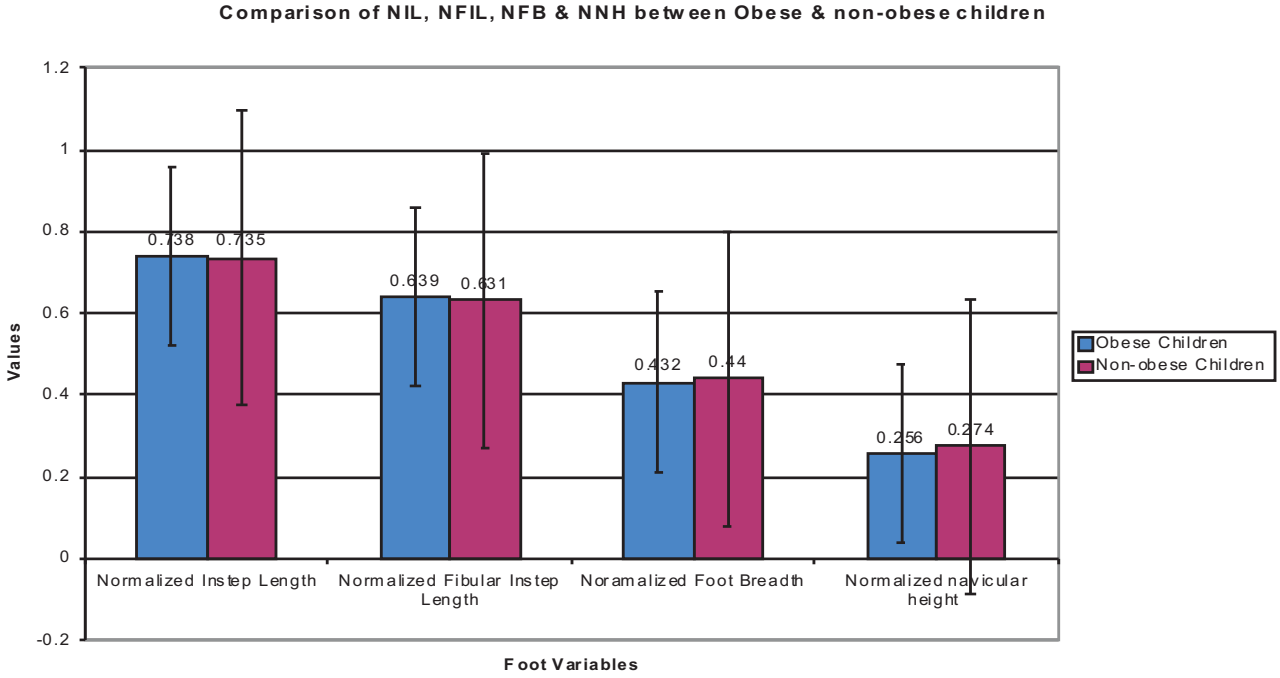
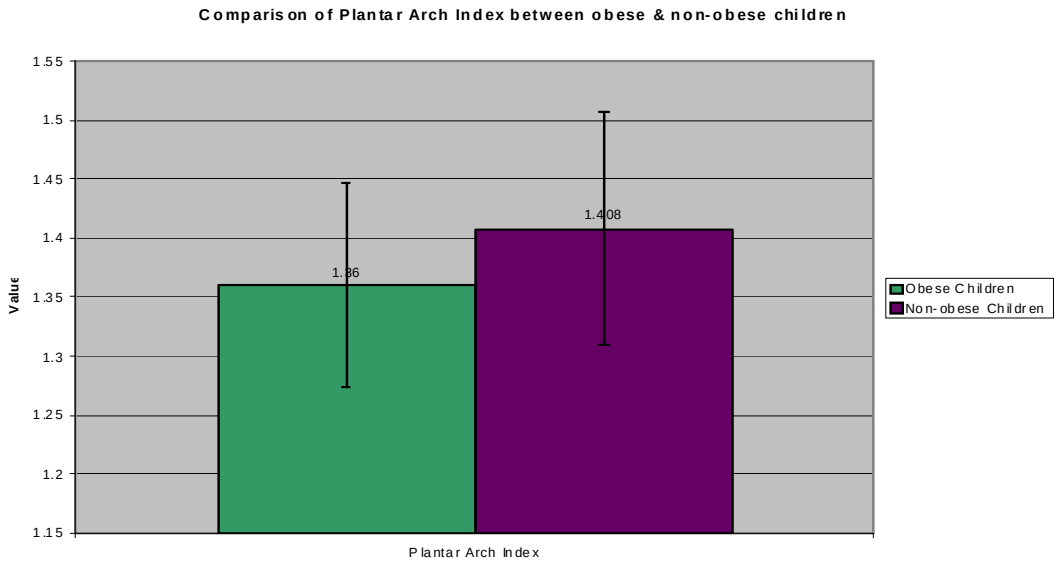


Fig.2: Shows comparison of Plantar Arch Index between obese & non-obese children



respectively, p was > 0.05 and hence it was insignificant.

DISCUSSION

The results of this study showed that no difference existed between the obese and non-obese children external foot measurements at the age group of 10-12 years. Thus alternative hypothesis was rejected & null hypothesis was accepted. In this study, mean values were calculated for 7 chosen external foot measures which are used to characterize the foot structure. Some of the mean values were found to be in agreement with values reported previously [9,10] whereas some did not. Non-obese children displayed a similar mean arch index value (1.356 ± 0.087) to those reported by Cavanagh and Rodgers [11] (1.348 ± 0.077) for 107 subjects (mean age, 11.5 years). Interestingly, this study found a higher mean arch index value (1.356 ± 0.087) compared to previous study [12] (1.021 ± 0.067), from which our normative reference values were derived. This difference may be because medial longitudinal arch development happens primarily through age, thus, higher plantar arch indexes are expected in younger children, while these indexes are lower in older children. Other authors admit that major variations on plantar arch happen until the age of 7. The suggestion of this index having a decreasing incidence up to approximately 5 years old, remaining stable after that, was responsible for our decision to study a group of children above that age, working with lower age groups we could reduce the usefulness of our indexes to the intended end.

The normalized navicular height did not show any difference between obese children group and non-obese children group. Previous researches have shown differences between the two with lower NNH in case of obese children. This variation can come as palpation of the navicular head is more difficult in full or 90% of weight bearing than in 10% of weight bearing. This finding may have occurred because the soft tissue on the medial border of the arch becomes taut in 90% of weight bearing. Although the measuring procedure was consistent within it, but in each turn the palpation might have been on a slightly different landmark in the 90% of weight bearing condition. The consistently higher values for navicular height suggested that perhaps the posterior portion of the navicular was being measured rather than the anterior portion.

Considering footprint a poor evaluation approach [13], still there is almost an uncountable number of authors who advocated its use [14-18]. The correlation between X-ray studies and footprint showed that the footprint is effective for individual studies and population-based investigations. Some cannot find a correlation between footprint and clinical measurement of the plantar arch, regarding it is invalid to determine plantar arch height, others also consider that footprints present several approach failures. The plantar arch index and the navicular vertical height are correlated, but the second is better, because it directly measures navicular, which is the key to medial arch, in addition to be easy to achieve.

Some researchers have incorporated the use of radiographs [19, 20]or photographs [21]to classify the medial longitudinal arches of their subjects. Hawes et al [22] measured the highest point of the soft tissue along the medial longitudinal arch in full weight bearing. Although this measurement, as well as footprint measurements, [23, 24] can be easily obtained, we do not believe that these measurements necessarily represent the state of the bony architecture of the foot. The soft tissue on the plantar surface of the foot is thick and variable and can mask the true bony architecture of the foot.

Saltzman et al[25]correlated measurements taken at 50% of weight bearing with measurements obtained from radiographs to determine their validity. The authors concluded that the measurements correlated well with the measurements obtained from radiographs. Measurements obtained from radiographs of talar height/ foot length, calcaneus to first metatarsal angle, and calcaneal inclination were compared with measurements of navicular height/footprint length, arch height/ footprint length, and talar height/footprint length. The measurements obtained from radiographs were different from the clinical measurements. Therefore, we do not believe that these measurements had concurrent validity. Dividing navicular height by foot length is important

because the height of the navicular may not give an accurate representation of the arch.

Plantar Arch Index & Navicular height are considered important to determine the presence of a flat foot. No statistically significant difference was found between obese & non-obese children feet, indicating that obesity does not affect the external characteristics of the plantar surface of children feet.

CONCLUSION

We concluded from this study that the external foot appearance of obese and non-obese children was similar and no difference was noted when compared using external foot measurements and footprints. Thus obesity doesn't have significant role on foot measurements at the age group of 10-12 years of children.

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Horticultural therapy on self esteem and motor skills of physically challenged children

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ABSTRACT

Horticulture Therapy is an integrated approach to human development using horticulture techniques with behavioral science. This paper attempts to present the results of the study to evaluate the impact of horticulture therapy in developing self-esteem and motor skills in physically challenged children. Fifty physically challenged children in the age group of 12-18 years were selected using purposive sampling. Motor skills of the children were studied using an observation schedule by inter observer agreement method. Assessment of self-esteem of the sample was done using a rating scale. The tools were constructed and standardized. Horticulture therapy included goal specific activities along with raising a vegetable garden. The data collected before and after horticulture therapy was analyzed using paired sample 't' test. The results revealed that there is significant impact on the development of self-esteem and motor skills in challenged children after attending the horticultural therapy programme.

Key Words: Horticulture therapy, Self esteem , Motor skills

INTRODUCTION

According to American Horticulture Therapy Association, horticulture therapy is a remedial process in which plants and gardening activities are used to improve the body, mind and spirits of people.[1] Seimpk [2] describes horticulture therapy as the use of plants by a trained professional as a median through which certain clinically defined goals may be met.[2] Horticultural therapy is thought to be an effective and beneficial treatment for the people of all ages, backgrounds and abilities.[3] Ulrich[4]indicated that the benefits of nature such as trees and other vegetables had positive influence on emotional and psychological state of the people.

Therapist and participants in horticulture therapy programmes usually report that there is positive benefits like social integration, increase in self confidence, self esteem , concentration learning of practical skills, reduce levels of stress and mental fatigue, enhanced physical activities and improved social cohesion.[5],[6,]The benefits of involvement in horticultural activities and exposure to nature can be seen in cognitive,[7] psychological,[8,9] social,[10,11] and physical[12,13] realms and research continues to reveal these connections across many groups of people. Studies have also shown that horticulture therapy reduces stress.[14,15]

Horticulture Therapy is an integrated approach to human development using horticulture techniques with behavioral science. Although horticulture therapy has been established as a form of rehabilitation in several countries not much study has been conducted in Indian context. Therefore this paper aims to find the impact of horticulture therapy on self-esteem and motor skills of the physically challenged children.

We have investigated the effectiveness of horticulture therapy with the hypothesis that (1) Raising garden and participating in horticulture therapy develops self esteem in physically challenged children. (2) Participation in horticulture therapy brings a positive improvement in the motor skills of the physically challenged children.

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MATERIALS AND METHODS

To prove the hypotheses observation schedule (using inter observer agreement method) for motor skills was constructed. In addition a rating scale was constructed and used to measure self esteem. The sample comprised of fifty physically challenged children in the age group of 12-18 years. The sample was selected using the purposive sampling method. Written informed consent was obtained from the subject and their parents after a detailed briefing of the experimental purpose and protocol.

Self Esteem Rating Scale (SERS) was used to measure the self esteem .The rating scale in the form of a questionnaire was developed strictly in accordance with questionnaire construction principles. The 3-point rating scale was subjected to pretesting, reliability and validity tests. All the children were rated using SERS, scoring 10 items of the questionnaire. The SERS was performed before and after horticulture therapy to asses the changes in self esteem. A score of more than 20 is considered to show a high self-esteem, and a score between 10-20 a moderate self-esteem and score below 10 as low self-esteem.

The motor skills of the children were assessed using an observation schedule by inter observer agreement method. Two observers carried out the observations simultaneously and later the average score of the two observations was taken. The motor skills observation schedule is an assessment tool, two point rating scale to assess the child's level of function in 8 gross and 5 fine motor skills task that represents the motor skills. The total score range is from 1 as a perfect dependent to 13 as a perfect independent. The observation of motor skills were ranging from eating using spoon, dressing the upper body, dressing the lower body, walking, cleaning the room using a broom, watering the can using rose can, holding the pen, washing the plates, climbing the stairs, writing legibly, making envelops, holding the cup, walking using the rail and walking using the clutches. Each child was scored before and after horticulture therapy. The study therapy consisted of three steps pre horticulture therapy, horticulture therapy and post horticulture therapy.

Pre Horticulture Therapy Session

In this session, the personal and socio- economic characteristics of the children were assessed with the help of the special education teacher. Tools were administered to assess the participants with respect to motor skills and self esteem.

Horticulture therapy Session

Training on Horticulture Production

This session included imparting training on raising, maintaining and protection of the horticulture therapy garden. The classes were handled by horticulture experts.

Raising Special Child's Garden or Horticulture Therapy Garden

The area chosen in each centre was such that it was easily accessible to the physically challenged children. The selected area was ploughed well and a grass path of 90 cm was kept so that physically challenged children can walk through.

As the participants of the present project were physically challenged children, the concept of the raising horticulture therapy garden was with 'NO DIG CONCEPT'. The plants were raised in clay pots, gunny bags, glass containers and hanging baskets as these procedures do not require digging with spade.

Potting mixture was prepared using river sand, red loam, dried cattle manure, bone meal in the ratio 1:2:1 respectively. Later this mixture was filled in polyethylene cover, clay pots, gunny bags and hanging baskets with the help of children and a laborer. After filling the sacks they were kept apart at a distance of 50 cm each so as to enable easy operations. Seeds were first sown in polyethylene cover and after two weeks the sprouted seedlings were transplanted to clay pots, gunny bags and hanging baskets filled with potting mixture. In addition to the seeds, stem cuttings were also planted. The children regularly irrigated the potted plants using sponges, which in turn helped them to improve their fine motor skills. The staff and the children did regular monitoring of the horticulture therapy garden.

The plants grown in the Horticulture Therapy garden were Ornamental plants: Rose, Orchid, Begonia, Mari gold, Zenia, Portulaca ,Vegetables:

Tomato, Okra, Amaranthus, Bitter gourd, Snake, gourd, Cucumber, Beans, Fruits : Papaya, Banana Tubers : Sweet Potato, Tapioca, Medicinal and Aromatic plants: Ocimum (Ocimum Sarictum), Panikurka (Coleus aromaticus), Phyllanthus, Alovera, Neela amari, (Indigoteratinctoria), Chittaratha (Alpiriyacalcarata), Asparagus (Asparagun racemosus), Brahmi (Bacopa monnieri) and Turmeric (curcuma domestica).

Each child was allotted a plant and the child was asked to suggest a name to the plant. The children were also informed that they were responsible for the plant that has been allotted to them in order to develop sense of belongingness and responsibility.

Physically challenged children were asked to water the plants by squeezing a sponge so that the action of squeezing the sponge enables them to improve their motor skills.

After one month, poultry manure, coir pith compost, and vermi compost were applied. The children did fortnightly weeding and pruning. Botanical pesticides were applied for controlling pests of the plants. Botanical pesticides viz. neem oil, bar soap, garlic extract, chilly powder, and kerosene and tobacco decoction were used.

At correct maturity stage of each plant, harvesting was done by the children.

Horticulture Therapy Activities

The following are the Horticulture therapy activities imparted to the physically challenged children:

a. *Making name tags using leaves and flowers*
b. *Clay Modeling and Designing a Garden using clay*
c. *Sand Crafts*
d. *Dry flower picture frames*
e. *Fresh flower arrangement*
f. *Combination planting*
g. *Making Greeting Cards using dry flowers*

Post horticulture therapy session

Post horticulture therapy survey was conducted. The children were subjected to standardized tests and rating scales to measure the effects of horticulture therapy. In order to assess the impact of horticulture therapy on psychomotor development of the physically challenged, the selected physically challenged were subjected to the standardized psychometric tests like self esteem rating scales . The motor skills of the children were observed systematically using Inter Observer Agreement Method before and after attending horticulture therapy activities.

DATA ANALYSIS

Data analysis was performed with the SPSS at Department of Statistics , Kerala University. The differences between the scores before and after horticulture therapy were calculated using t-statistics.

RESULTS

Pre and Post Horticulture Therapy scores were statistically analyzed to find the impact of horticulture therapy. The observations showed that all the children those who participated in the horticulture therapy programme had improved motor skills and increased self esteem.

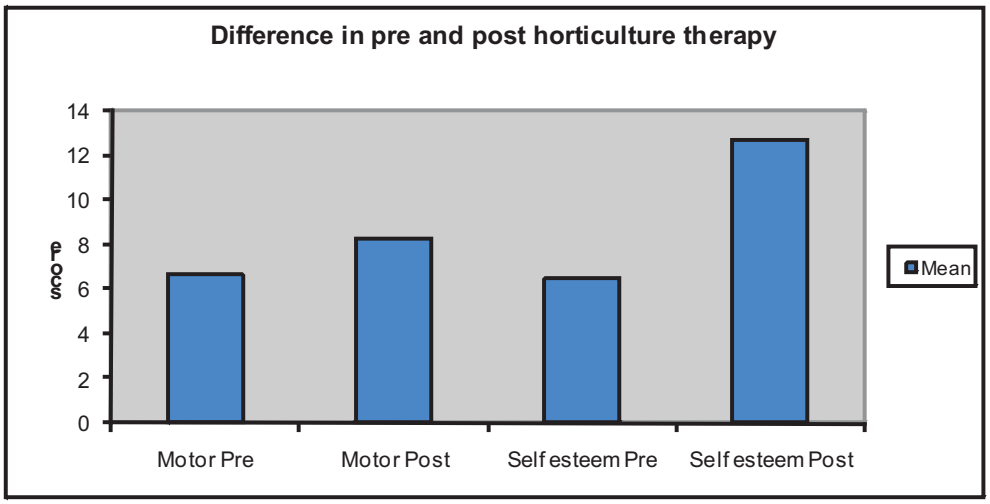
Table 1: **Mean of Self Esteem and motor skills of physically challenged children before and after Horticulture therapy**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Motor Skills Pre	6.67	57	1.756	.233
	Motor Skills Post	8.21	57	1.398	.185
Pair 2	Self esteem Pre	6.44	57	2.044	.271
	Self esteem Post	12.67	57	1.574	.208

Table 2: Paired Sample test of Self Esteem and motor skills of physically challenged children before and after Horticulture therapy

Paired Samples Test		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Motor Skills pre – post	-1.544	1.402	.186	-1.916	-1.172	-8.311	56	.000
Pair 2	Self Esteem pre – post	-6.228	2.835	.375	-6.980	-5.476	-16.587	56	.000

Figure 1: Differences of Motor Skills and Self Esteem of physically challenged children before and after Horticulture therapy



The Table shows that there is a significant difference in the scores of self esteem and motor skills in pre and post horticulture therapy. The pre horticulture therapy scores of self esteem was lesser than the post horticulture therapy scores. And pre horticulture therapy scores for motor skills were less than the post horticulture therapy scores. Hence the hypothesis 1 and 2 are accepted.

DISCUSSION

The result of this study shows that the horticulture therapy can improve the self esteem and motor skills of the physically challenged children.Horticulture therapy has the following features 1) Children can objectively observe vegetable growing. 2)Children can actually see the result of his/her efforts when vegetables has grown. 3)Children can amicably share his/her achievements with other people 4) Children feel that they are capable, all these leads to an enhance in the self esteem of the children. Horticulture Therapy contains multifunctional elements and children can move from fundamental activities to complex activities. Activities like clay modeling and watering using a sponge also improve the fine motor skills of the child.

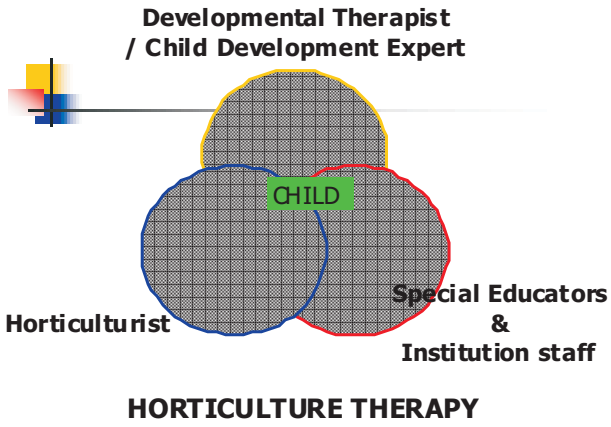
CONCLUSION

The research findings of the present paper implies that horticulture therapy can improve the motor skills of the physically challenged children. There is a remarkable improvement in the self esteem of the children who underwent horticulture therapy. The broad range of activities captured the attention of everyone including the teachers and parents. Children were able to interact among themselves and questions were asked during each activity. Hands on activities allowed the children to practice what they learned in the session.

RECOMMENDATIONS

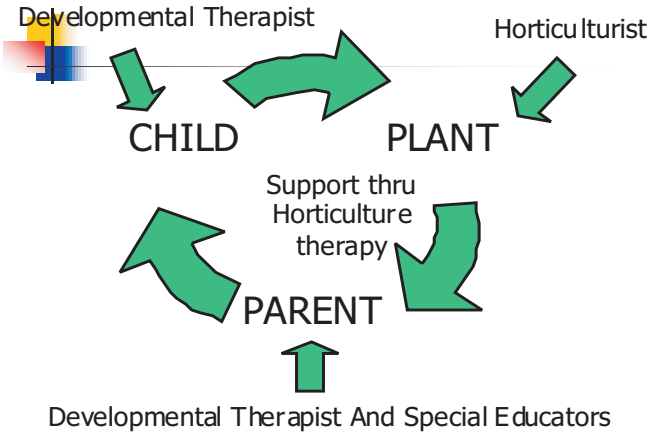
In horticulture therapy, the paramount is the welfare of the child who is undergoing the therapy , the yield is only secondary. The horticulture therapy focuses on the child who takes part in the therapeutic activities. It is a team work of three groups coming together in achieving the goal. Child Development Experts, Horticulturists and Special educators need to come together and work as a team focusing on the child development through horticultural therapy.

Figure 2: Team Work Based, Child Centered Horticultural Therapy



Horticulture therapy is a process of cyclic system of support. In this process the child supports the plant. The plant supports the parents by giving yield which can add on their daily purchase of vegetables and fruits. The parent again supports the child and it encourages the child in supporting the plant. The child is monitored and supported by a developmental therapist. A plant is protected and maintained with the help of a horticulturist.

Figure 3: Support System Through Horticultural Therapy



Developmental therapist and Institutional staffs regularly need to supports the parents by counseling and motivating them.

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Use of cryotherapy in sports injury rehabilitation: Report of a survey

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ABSTRACT

Though Cryotherapy is widely used in the field of Sports injury rehabilitation, due to its therapeutic uses and availability, the method of application varies among Sports injury specialists. Appropriate selection and application of therapeutic modalities is the key to success in rehabilitation. Lack of structured guidelines pertaining to sports injury rehabilitation led to the considerable variability in Practicality. It is important to find out the variability in the usage of Cryotherapy, in order to establish an acceptable protocol., **Method:** A structured Telephonic survey was conducted among 40 professionals working in the field of Sports., **Results:** There was diversity in the method of application of cryotherapy among the professionals working in the field though all of them preferred cryotherapy in acute sports injury management**.** Direct applications by using simple methods were considered by the majority of the therapists. Ideal dosage of cryo application remains controversial**., Conclusion:** There is a need to prepare an Evidence Based Guideline regarding the application of Cryotherapy in sports injury Rehabilitation.

Keywords: Cryotherapy, sports injury, physiotherapy, therapeutic modalities

INTRODUCTION

Return to activity after an injury is one of the most important aspects of successful rehabilitation. (Chris bleakly and Suzanne McDonough , 2004, Tricia J Hubbard and Craig R Denegar ,2004 Tricia J Hubbard et al., 2004 - give numbering) Cryotherapy is one among the simplest and oldest therapeutic modality in the treatment of acute soft tissue injuries.(Nicole et.al ,2002 Chris M Bleakley, 2007 – give numbering) . Application of ice mainly helps to decrease the tissue temperature, diminish pain, metabolism and muscle spasm, thus facilitate recovery. (Michael Andrew Kowal, 1983 – give numbering)

Although ice has been one of the most frequently used modality for soft tissue trauma, the strength of the evidence supporting its use is poor. Most of the research in the field of cryotherapy has been done on post operative cases wherein it reduces pain and allows early movement; however the rationale for the use of ice in sports and for rehabilitation purposes remains different.

There has been an attempt to establish international guidelines for the use of cryotherapy; however most of them have not been able to come up with a specific protocol for the use of the same. (Kate Kerr et al., 1998 give numbering). The majority of the guidelines that exists for cryotherapy have failed in formulating well structured guidelines mainly owing to the lack of well designed randomized controlled trials. Such dearth of literature has left us to rely on established recommendations for cryotherapy mentioned in standard textbooks, which in itself is not conclusive and has lead to considerable debate over the selection of parameters in the clinical scenario.

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Current era of evidence based practice emphasizes research evidence, clinical expertise and the inclusion of patient values in rehabilitation. Management of acute injuries in the sports arena poses challenges to professionals working in this field. Cryotherapy as a modality stands no dispute but there is no uniformity in the method of application and dosage. It has been felt that there is a need to explore the usage of cryotherapy in the developing countries.

The objectives of this study were as follows:

1.To evaluate the current clinical practice of cryotherapy used by experts in the filed of sports injury rehabilitation

2.To explore the need of a standardized protocol for the administration of cryotherapy in acute soft tissue injury.

METHODS

A structured telephonic interview was conducted among the various sports specialists. The survey was conducted on a national level with the therapists included from various areas of the sporting field. The survey consisted of both open ended and closed ended questions. There were eight simple questions which were asked regarding the method of cryotherapy, duration of application and the indications of use. The mean time spent per respondent was 15 minutes. The responses that were obtained were analyzed and are presented here using descriptive statistics

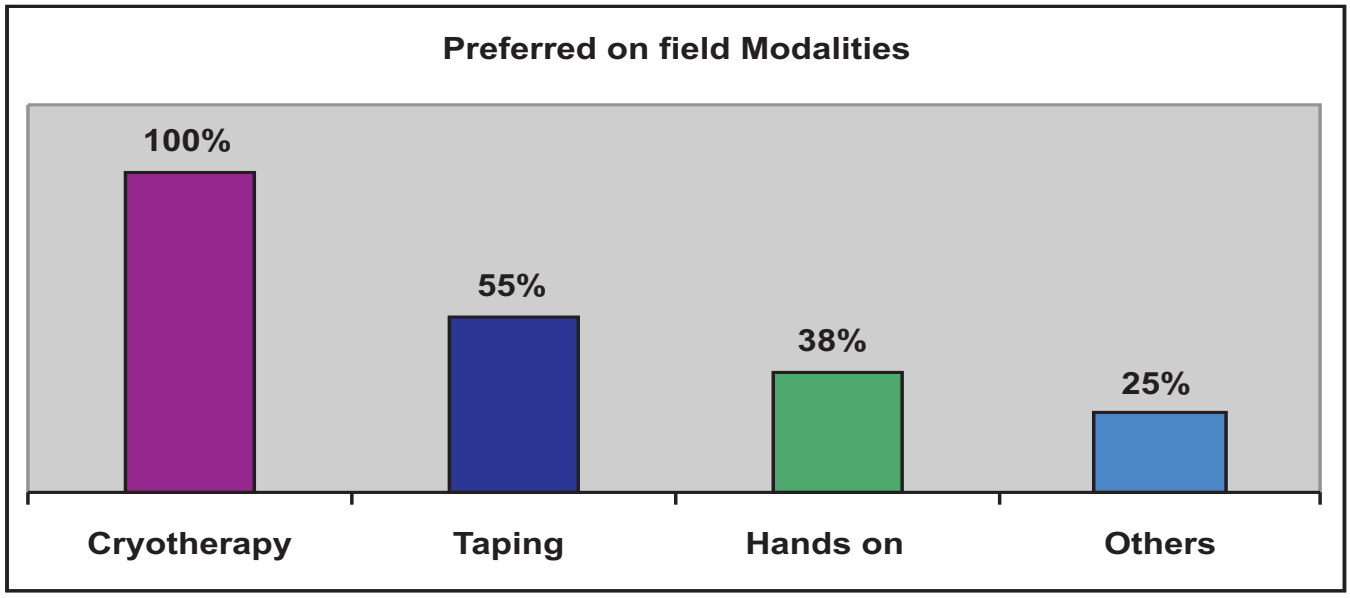
RESULTS

We interviewed forty sports specialists who were part of teams participating at the state, national and international levels. Our respondents were mainly in the mean age group of 29 years ±2.5 years. Most of them had a mean experience of 3.9±2.6 years in the sporting field.

Majority of our respondents were specialised in sports physiotherapy (92.5%),one was a sports medicine doctor and we had two therapisits who were bachelors in physiotherapy and were with teams at the national level.

When asked about the modalities that were used on field in acute injuries 100% of the respondents said that they have used cryotherapy.

Figure 1: Most Preferred Modalities in Sports Field

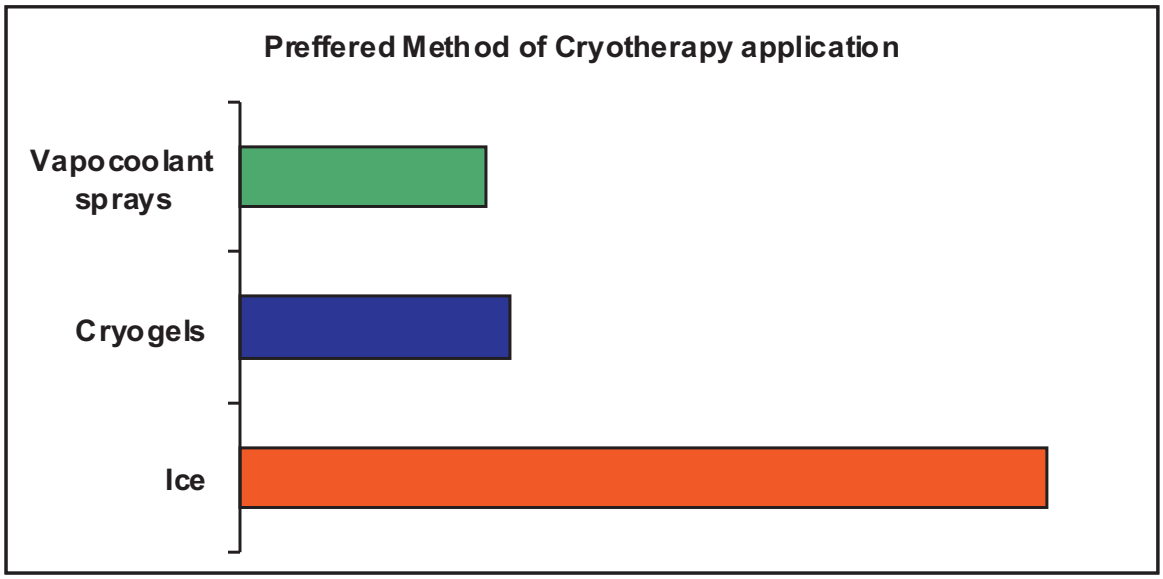


About 55% have also used taping . 38% said that they have used hands on treatment in terms of sports massage and post isometric relaxation techniques , while 25%feel that they most often rely on first aid kits - (repetation of the Figur 1. The same thing is mentioned in text and presented in figure, try to avoiv such type of repetation) .

In case of an acute injury all the respondents answered that the most preferred modality is cryotherapy but majority of them differed in the method of application of ice.

(90%) preferred the use of ice in a simple polythene bag or crushed ice applied with a towelling. Few of them even preferred the use of

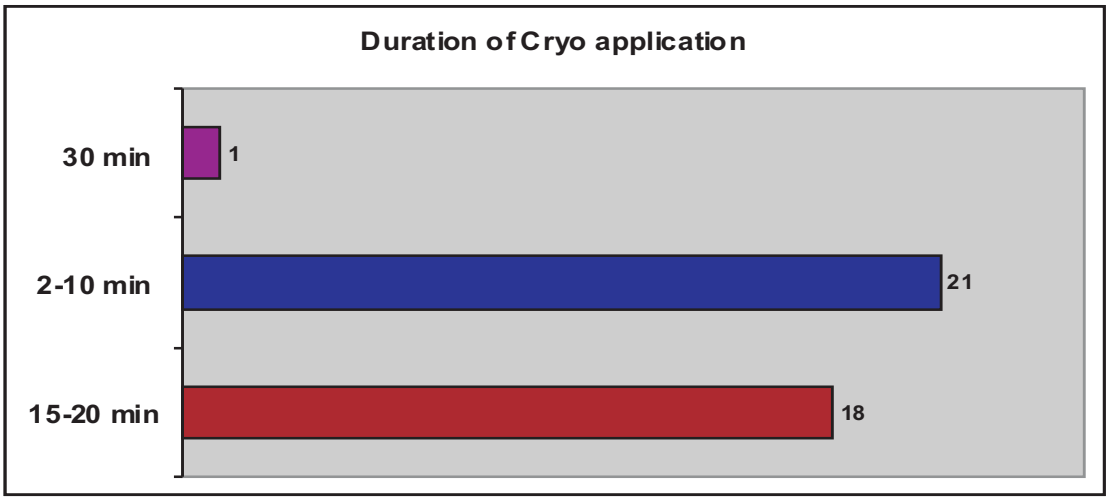
Fig 2: Respondants Preferred Method of Cryotherapy Application



ice massage. (30%) of the therapists stated that cryogels were also used ,which were also found to cause considerable cooling – (repetation of the figure 2). Most of these applications were given in combination with compression or elevation as it is done traditionally in case of any acute soft tissue trauma. Very few of them(27%) reported the use vapocoolant sprays as part of their management in order to produce an immediate analgesic effect.

There was again considerable controversy over the duration of application. Among the responses that were obtained 2 to 10 mins of ice application

Fig 3: Duration of Cryo application



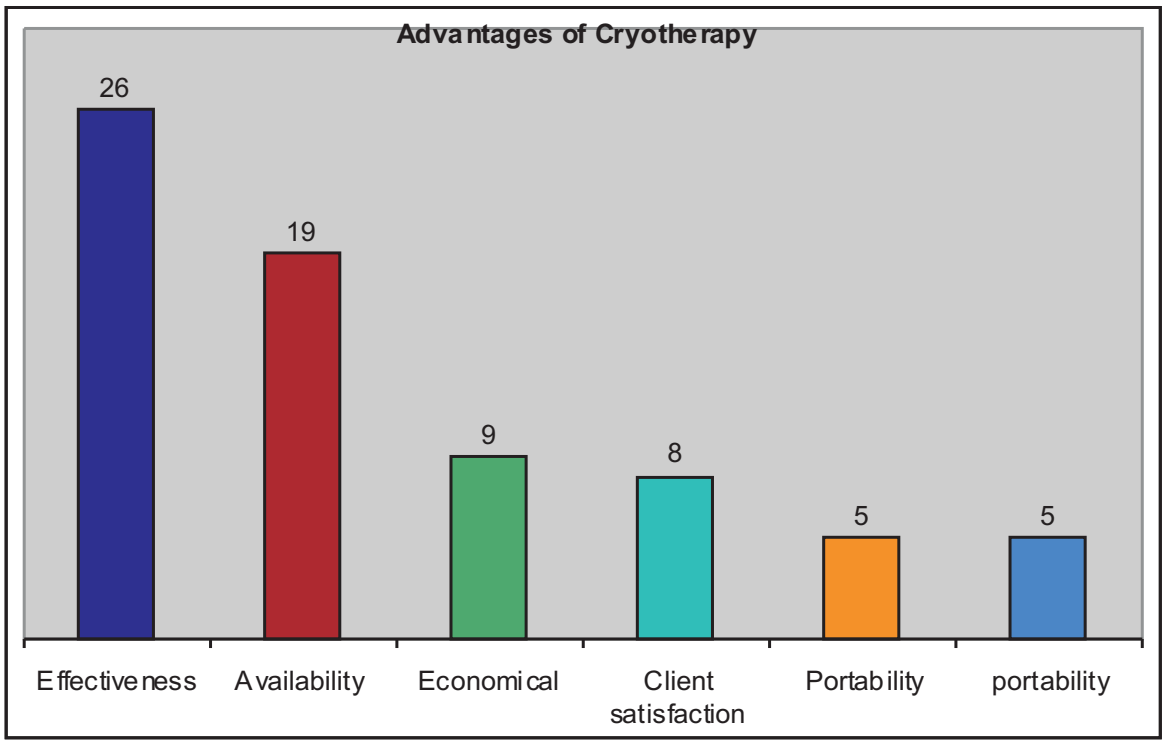
was the most preferred. Therapists also preferred application of ice for a period of 15 to 20 mins to achieve a cooling effect.

Though cryotherapy was widely used in the acute set up the situation was quite contrary when the therapists were asked about their choice of treatment in chronic injuries. Most of them suggested(57.5%) that they would go with other modalities and found that cryotherapy was effcient only in acute injuries . 42.5% felt that cryotherapy was equally effective for chronic injuries.

One of the major precautions that were reported was not to apply the ice directly over the part to be treated. Open injury was another precaution which was highlighted during decision making. Few of the therapists suggested that they follow textbook contraindications while others felt that they were no specific precaution that is necessary for an effective modality like ice.

These were the advantages of cryotherapy over the other modalities in acute sports injuries expressed by the respondents.

Fig 4: Respondents Perceived advantages of Cryotherapy



DISCUSSION

Respondents of the present study were associated with teams at state, national and international levels. As mentioned earlier most of our respondents were specialized in sports physiotherapy.

When asked about the modalities that were commonly used on field most of the therapists felt that cryotherapy, taping and hands on techniques were the most commonly used therapeutic modalities. The choice of the modality would ultimately depend on the nature of the injury and the discretion of the therapist. The hands on techniques that were commonly cited were techniques like sports massage, post isometric relaxation, stretches, effleurage, kneading depending on the injury at hand. These techniques may be used along with Cryotherapy.

The effectiveness of cryotherapy in the treatment of acute soft tissue injury is well established though the physiological mechanisms still remain unclear. Literature says that cryotherapy is the modality of choice in acute injuries (kate kerr 1998, Bleakly and suzanne mcdonough, 2004, Tricia JH 2004, Mike S, 2005-

give numbering).Cryotherapy definitely improves outcomes after an acute soft tissue injury facilitates repair and hastens recovery. In case of an acute soft tissue injury cryotherapy mainly prevents the secondary hypoxic injury (Mark A Merrick, 2002- give numbering **)** that ensues after the primary damage thus preventing further deterioration of the condition.

Therapists differed in their method of application of ice. Majority of them preferred application of crushed ice in a towel or polthythene bag. Few reported that the application of ice massage was not practically possible in most of the situations on field. Most of the therapists who were associated with state teams mentioned that they did not have access to cryogels or vapocoolant sprays which may not be the situation when they work for elite teams. Those who preferred using cryogels state that while using crushed ice the temperature of the ice cannot be maintained which is a disadvantage. Vapocoolant sprays were effective in causing instant pain reduction especially for muscular injuries. the findings of the survey go well in accordance with the study carried out by **(**Rosalind B. Belitskyet al .,1986), (Linda S. Chesterton, 2002**)**, (Rotsalai Kanlayanaphotporn 2005) , (Jane kennet et al., 2007- give numbering)**,** reporting that crushed ice application or ice water immersion was the most effective in reducing skin temperature than cryogels. Research reports that the application of cryogels were more effective than no intervention at all (Olavi V. Airaksinen et al., 2003 - give numbering).

There was no consensus regarding the ideal duration of application. Most of the therapists felt that it entirely depended on the game as well as on the coach and the time that is provided to the physio to attend to the injury The responses varied from duration of ten minutes to twenty and thirty minute applications. There is insufficient literature to support an optimal dose of cryotherapy. An intermittent ice application of 10 minutes is equally beneficial as a 20 min continuous application (Bleakly et al .,2006- give numbering). There were considerable differences that we found in the frequency of treatment. A previous research had reported **(**Beth L. Atnip and Jean L. McCrory, 2004- give numbering) that intermittent icing in between events should be undertaken in acute sports injuries. There was no agreement on the optimal frequency of treatment. Few of the therapisits advocated the use of every 2 hourly treatments for the first 24 to 48 hours while the others felt that a 4 hourly shot of cryo was sufficient to produce an effect. Beth (- give numbering) in his study reported significant improvements with 4th hourly administration of cryotherapy. Therapists felt that prolonged icing would evoke the lewis hunting reaction which is definitely not the aim in acute trauma, however reactive vasodialation sets in only after 20 min of cold pack application **(**Craig Taber et al., 1992- give numbering) . Ten minutes was the ideal time for the numbness to set in and for the athlete to be put back into the game. A lot depends on the nature of the game, wherein the therapist may not get sufficient time for cryo applications. In such situations therapists feel that the player may be called out of the game in order to nurse his injury. One of the therapists (put references with numbering) mentioned that the decision making factor would be the presence of subcutaneous fat as in obese individuals which would warrant an ice application beyond 15 min to achieve significant cooling.

Therapists quoted direct application of ice as a contraindication mainly due to the resulting vasoconstriction may enhance pain. So ideally ice needs to be applied with a toweling or in a simple polythene bag and then applied over the part. Ice massage seems to have an additional effect on delayed onset muscle soreness. Standard text book contraindications include application of ice over areas of sensory deficit, hypersensitivity to cold, care while applying to the upper extremities which were also found in our survey. Open injury was also considered as one of the major contraindications. Few (Put reference with numbering) therapists felt that in open injuries cryotherapy can be used to reduce the bleeding. Few even practiced dressing the wound prior to the application of ice to the part. In events like boxing where open injuries are quite common cryotherapy is extremely useful in reducing the edema and the bleeding. Standard assessment like sensory evaluation before application of any modality may not be possible in a sporting filed so most of the occasions the therapist will have to blindly go ahead with the use of this popular modality.

When asked about whether cryotherapy was part of chronic injury management, 57.5% of the therapists did not feel the need to apply ice on chronic injuries. The effectiveness of ice in the management of post surgical cases is well established (Lucy A. Lessard et al., 1997 - give numbering).Cryotherapy has significant contributions in reducing joint effusion and prevent muscle inhibition and facilitate the motor neuron pool (J Ty Hopkins et al., 2001- give numbering) .cryotherapy in post acute rehabilitation can minimize swelling before the commencement of exercises (Debra J. Cote, 1998 - give numbering) . 47.5% of the therapist strongly felt that ice could be used in chronic injury management especially for post surgical cases eg: post op ACL injuries. This may be the time when cryokinetics and cryostretches come to play where the patient will be able to better tolerate the rehabilitation procedures after the application of ice.

CONCLUSION

This survey found that cryotherapy was considered superior to the other modalities. The reasons which were quoted were mainly its effectiveness, portability, and the patient satisfaction which affects the outcomes. Cryotherapy as a modality is simple and economical and is most often the modality at hand for a physio who works for a state level team. The added advantages of cryotherapy over taping stands undisputed since it causes instant reduction in pain and is easy to apply. Taping on the other hand requires skill and is expensive. The role of taping in the prevention and treatment of sports injuries has been questioned over the years. The role of taping as an adjunct is an added tool when the athlete enters into a well structured rehabilitation protocol. As far as the initial management of any soft tissue injury cryotherapy is the primary modality.

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Effects of preoperative exercise programme in hospitalised patient's undergoing mitral valve replacement surgery

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Jyoti Ganai**
Jamal Ali Moiz***
Md Abu Shaphe****

ABSTRACT

objective: to evaluate the effect of preoperative exercise programme in mitral valve replacement surgery in decreasing the incidence of ppcs, increasing the pulmonary function and decreasing the hospital stay. **Methods:** 30 subjects participated in the study. Subjects were randomly assigned into 2 groups: pre-operative exercise program and usual care (n=15in each group). 3 days pre-operative exercise program was given to the group 1. Outcome measures were ppc, hospital stay and pulmonary function test and 6 minute walk test. **Results:** paired t-test was used for within group comparison of pretest and post test measurement and again t-test was used for between group comparisons of the 2 groups. The result of the study showed that the group receiving preoperative physical therapy had shown significant reduction in hospital stay and ppc although there is no significant change in terms of pft.,**Conclusion:** it is recommended that preoperative exercise program should be included as a part of the treatment protocol in the rehabilitation of mitral valve surgery patients.

Key words: preoperative exercise program, preoperative patient education, ppc, hospital stay, mitral valve replacement surgery.

INTRODUCTION

Surgical treatment of rhd patients involves replacement of damaged heart valve with mechanical or bioprosthetic mitral valves. During cardiac surgery, the use of general anesthesia and muscle paralysis, mechanical ventilation and thoracotomy substantially influence lung function.[6] causing changes in lung volume, diaphragmatic dysfunction, respiratory muscle strength, pattern of ventilation, gas exchange, and the response to carbon dioxide and oxygen concentrations[1,2,3]. As a consequence of these changes , patients undergoing cardiac surgery have an increased risk of postoperative pulmonary complications (ppcs), which lead to increased postoperative morbidity and mortality,[4,5] increased use of medical resources, longer hospital stay, and increased health care costs.[4, 5, 6]

as a result of the generally high incidence of these complications (including mortality) and the high costs of hospitalization, efforts have been made during the last decade to identify those patients who have a higher chance of developing such complications, and to find ways to prevent their development[4,7]. Considerable effort has been put into preventing and treating ppcs, but there is no consensus on the most appropriate or effective remedy. Controversy exists concerning the possible overuse and abuse of many of the therapeutic modalities commonly[8, 9] used for the prevention and treatment ppcs.

physical therapy was usually given after the operation, whereas the preferred strategy is to identify, on the basis of known risk factors, and treat patients who might benefit the most from physical therapy before surgery[10]. A few studies

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have demonstrated that preoperative physical therapy in cardiac surgery has advantages over postoperative care alone [11]. The effects of these programs in decreasing the incidence of ppcs, increased the pulmonary function and decreased the hospital stay and identifying those patients who might benefit from these programs, i.e. All patients or only high-risk patients, have not been proven indisputably [12].

Objective of the study: to assess the effect of preoperative exercise programme in hospitalized patients undergoing mitral valve replacement surgery.

statement of the question: does preoperative exercise programme prevent ppc, decrease the hospital stay, increase 6 minute walk distance and improve lung function in patients undergoing mitral valve replacement surgery?

METHODS

Thirty patients both males (18) and females (12) with mean age of 41 years were included in the study on the basis of inclusion and exclusion criteria.

Inclusion criteria

1 Patients who were planned for elective MVR.

2. Age group between 30-60 years, including both genders (male/ female).

3. Co-operative and motivate

4. No history of musculoskeletal and neurological disorder

Exclusion criteria:

5. Emergency surgery,

6. Left ventricular ejection fraction (LVEF) < 35%

7. Multiple valve replacement surgery.

Method of assigning subjects: subjects were randomly divided into two groups.

Group-1 (experimental group) received both pre operative exercise programme and post operative cardiac rehabilitation programme.

Preoperative exercise programme: total 30 min daily for 3 days which includes

1. Incentive spirometry : 10 repetitions × 3 sets × twice daily ,

2. Forced expiratory techniques : 5 repetitions × 3 sets × twice daily

4. Patient education (aboutpostoperativecardiac rehabilitation).

5. Post-operative intervention: cardiac rehabilitation

Group-2 (control group) :preoperative intervention: patients in this group were received usual care. (2) post-operative intervention: cardiac rehabilitation.

Study design

A different subject pre test and post test design was taken in which the dependent variables (6mwt, pft) were measured 3 days before surgery and on 7th postoperative day.

Dependent variables

Following variables were measured three days before surgery and again on seventh postoperative day.

1. Forced vital capacity (FVC)

2. Forced expiratory volume in one second (FVC)

3. FEV1/FVC

4. FEF_{25-75}

5. Six minuit walk distance (6MWD)

6. Rate of perceived exertion (RPE)

7. Postoperative-pulmonary complications (PPCs)

8. Length of hospital stay (LOS)

Protocol

A subjective cardiovascular assessment was done prior to selecting patients for study. Subjects who were found suitable based on inclusion criteria for participation were requested to fill up a consent form seeking their willingness to participate in study. After taking the total cardio-pulmonary assessment the 6mwt & pft will be

performed on 3 days before surgery. After enrolment subjects were randomly (first cum first basis) divided into two groups.

Patient subjective assessment and spirometery measurement 6mwt were obtained, 3 days prior to surgery. All spirometery tests were performed with the patient in sitting position according to ats standard guidelines.[90] the measurements were repeated at least three times and the best recorded results were used as data. The spirometery was again repeated on 7th postoperative day. The following variables were recorded preoperatively and post operatively FVC, FEV1, FEV1/FVC, and FEF25-75%.

Six minute walk test was also conducted preoperatively 3 days before surgery and at the 7th postoperative day.

The ppcs grading and total hospital stay (HOS) were recorded on 7th postoperative day. PPCs were recorded from the postoperative notes on the basis of criteria [26]

Hospital stay were recorded from the nursing notes (ICU stay + ward stay) [26]

Statistical analysis

Statistical calculation was done by using scientific package for social sciences (windows version-15.0, SPSS chicago. Il, USA).

RESULTS

Pre and postoperative between group analysis at baseline between group comparison by independent t- test showed that, there is no significant difference in between groups. At post operative day-7, independent t-test results revealed fev_1 of group a was significantly different than the group b (p = 0.002). Ppc's was also found to be statistically different (p = 0.005). Los was also found to be statistically different (p = 0.000).

FEV1 between group comparision

The between group comparision was done by independent t-test. The value indicates that there is a statiscally significant between group-1 and group-2 (p = 0.02)

Comparision of ppc's between groups the between group comparision was done by independent t-test. The value indicates that there is a statiscally significant between group-1 and group-2 (p = 0.005).

The between group comparision was done by independent t-test. The value indicates that there is a statiscally significant between group-1 and group-2 (p = 0.000).

Figure 1: between group comparision of FEV1

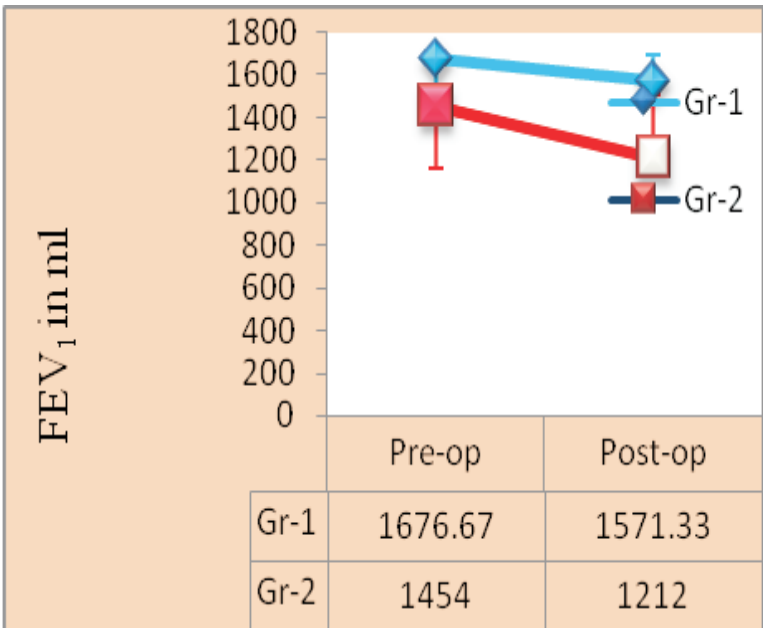
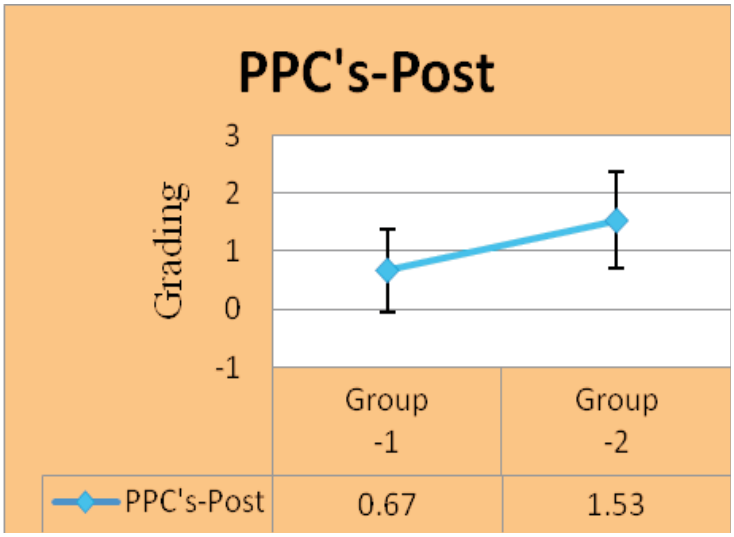


Figure 2: between groups comparision of PPC's Comparision of hospital stay between Groups



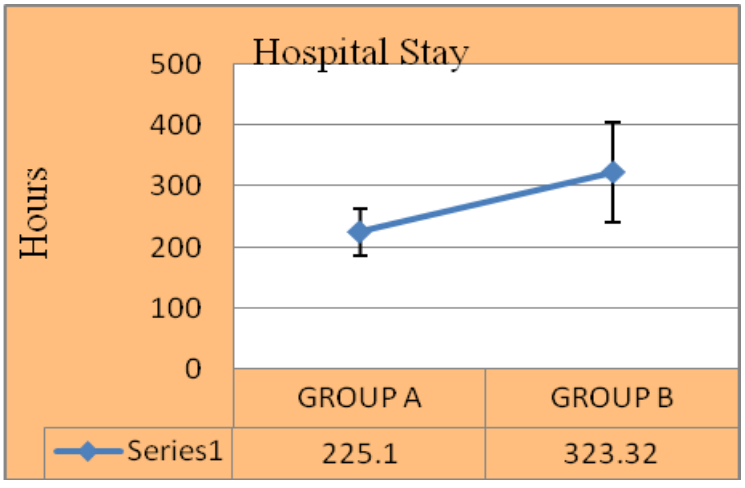
Comparison of FVC, FEV1/FVC, FEF25-75, RPE, 6MWD between groups

The between group comparision was done by independent t-test. The value's indicates that there is no statistically significant between group-1 and group-2, FVC (p = 0.065), FEV1/FVC (p = 0.157), FEF25-75 (p = 0.149), RPE (p = 0.149), 6MWD (p = 0.189).

DISCUSSION

This study was designed to determine the effect of preoperative exercise programme on pulmonary function, PPC's, hospital stay and 6MWD in patients undergoing valve replacement surgery where in the experimental group was given preoperative exercise programme for 3 days and control group was given usual care one day before surgery. The demographic variables (age, height, weight, BMI) of all patients were not found statistically significant(0.560, 0.281, 0.790, 0.689), thus showed both the groups were comparable.

Figure 3: Between groups Comparision of Hospital Stay



The results from the study revealed that there were significant differences in the length of

Figure 4. Measurement of pulmonary function using spirometer

Figure 6: Patient performing shoulder ROM exercises (Post-operative)

Figure 5: Patient performing incentive spirometer (Post-operative

hospital stay and PPC as measured at post operative periods. This study showed that the experimental group is found to be better than control group in terms of reduction of PPC's and hospital stay.

In the present study, a reduction in the hospital stay can be observed among the patients of the Intervention group. The mean hospital stay of experimental group is 225.10+38.42 hours and control group is 323.32+81.42 hours The mean difference of 98 hours is observed in experimental group, when compared with the control group ($p = 0.000$). A reduction in the hospital stay was also observed by Stein & Cassara[94] who reported a reduction in the hospital stay of patients who received physiotherapy in the preoperative and postoperative periods, when compared with the patients who did not perform physiotherapy. Semanoff et al [95] also reported a reduction in the hospital stay for those patients who received two or more sessions of physiotherapy (ventilatory exercises, cough and precocious mobilization, as well as information about postoperative procedures) in the preoperative period of cardiac surgery. They observed that patients submitted to valve surgery who received information in the

preoperative period were discharged eight days before those who were not treated with respiratory physiotherapy in the preoperative period. Additionally, Celli et al.[13] reported a reduction in the hospital stay in the group who received guidance on ventilatory exercises (9.6 ± 3.2 days in hospital) in relation to a Control Group (13 ± 5 days in hospital). In a study performed by Healy et al.[14] with 321 patients, in which 181 received instructions (ventilatory exercises with deep inspiration, coughing, specific explanations about the surgery in the preoperative and postoperative periods) and 140 patients who did not received any kind of intervention, the hospital stay was reduced by three to four days for the group of instructed patients. The decrease in hospital stay can be explained on the basis of reduction in anxiety[15] and adverse psychological[15] results by the administration of pre-op exercise and education. There is also a reduction in the PPC's by the pre-op exercise which in turn leads to reduction in the hospital stay. In the present study the incidence of postoperative pulmonary complications was investigated and analysed. A reduction in the PPC's can be observed among the patients of the Intervention Group, when compared with the control group (p = 0.05). Eight patients of the investigation group and thirteen patients of the control group developed some kind of postoperative pulmonary complications. Additionally it was seen that patients of the control group had a greater incidence of postoperative pulmonary complications. There is a statistically significant difference between groups. Six patients in the intervention group and four patients in the control group developed grade-I postoperative pulmonary complications according to our PPC's criteria. Two patients in the intervention group and eight patients in the control group developed grade-II postoperative pulmonary complications according to our PPC's criteria. One patient in the control group developed grade-III postoperative pulmonary complications and none of the patients in the intervention group developed grade-III postoperative pulmonary complications. One patient in the intervention group and four patients in the control group developed clinically significant postoperative pulmonary complications according to this PPC's criteria. The results of this study are supported by Heray et al [17] also reported a reduction in PPC's (pneumonia) for those patients received pre and post operative cardiopulmonary rehabilitation when compared with the patients who received usual care .the reason for the same as given by him is that the pre-op lung expansion exercises leads to an increase in the mobility of the diaphragm[16]. Exercise during pre-op period also leads to reduction of the dysfunction of respiratory muscle caused by the effect of surgery. This dysfunction could lead to a reduction in the VC, TV and TLC [23]. It also helps the patient in doing the post-op exercises effectively as they remember how to do it [18]. The effect of all these things in conjunction can explain the reduction in PPC. The proper ventilation in the lung will also reduce the incidence of atelectasis.

In the present study the reduction of the pulmonary volumes can be observed in both the Intervention and Control Groups especially from the preoperative period to the 7th postoperative day. A significant difference can be observed in terms of FEV1 among the patients of intervention group, when compared with the control group (p = 0.02). There is no significant difference in terms of FVC (0.065), FEV_1/FVC (0.157), FEF_{25-75} (0.149). A similar result was reported by Meyers et al.[22] the pulmonary volumes (FEV1, FVC) reduced in the postoperative period [19] with a maximum decrease on the 1st postoperative day, returning to close to the preoperative levels by the 5th postoperative day[22]. This decreased from the preoperative period to the 1st postoperative day but there was an improvement, but without total recovery to the preoperative values by the 6th postoperative day in the Intervention and Control Groups. These tests depend on the understanding of the exercises to be performed and on the desire of the patient to collaborate in making an effort to perform the movements[20] Thus, it is accepted that factors, such as, pain, alterations in the ventilatory mechanics[7] due to the sternotomy[19,21] on the pulmonary function.

The 6 MWT is not routinely used for the assessment of functional capacity of patients who are waiting for cardiac surgery. In this present study a reduction in the six minute walk distance from preoperative to postoperative day 7 can be observed in both the groups. The mean difference of six minute walk distance from preoperative to

postoperative day 7 in intervention group is 15 meters, and in control group is 21 meters. This study shows that there is no statistically significant difference between Group A and Group B in terms of 6 MWD. This shows that there is a no effects of preoperative exercise programme (3 days) on 6 Minuit walk distance in patients following mitral valve replacement surgery.

CLINICAL RELEVANCE

The result of this study suggest that preoperative exercises programme and education about postoperative exercises should be includes as the part of the rehabilitation of the patients undergoing valve replacement surgery to avoid PPC's, reducing the length of hospital stay. These exercises are also proven to be safe.

This intervention will in turn to reduce the expenditure due to prolonged hospital stay and the expenditure in treating PPC's.

LIMITATION OF THE STUDY

One of the limitation of this study is the small sample size. There is also a shorter duration of protocol for the preoperative exercise regime as majority of the patients are not admitted earlier than three days prior to the mitral valve replacement surgery.

FUTURE RESEARCH

Future research is needed to observe the effect of preoperative exercise regime in mitral valve replacement surgery patients with a larger sample size and for a longer period of time.

CONCLUSION

The preoperative exercise programme has been shown to be more effective than the usual care in the rehabilitation of the patients undergoing mitral valve replacement surgery in reducing hospital stay and PPC's. Therefore the experimental hypothesis is accepted.

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Virtual reality training: An invaluable tool

Nidhi Kashyap
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Abha Sachdev

ABSTRACT

In this paper, the potential use of virtual reality for use with persons with vestibular disorders is discussed. Just as optimal intervention for individuals with vestibular disorders commonly involves multiple disciplines, so are multiple disciplines conducting excellent research that demands vigilance in the practicing clinician. Vestibular exercises progress from simple movement in simple environments to complex movements in complex environments. The value of virtual reality systems for the investigation and rehabilitation of cognitive and perceptual impairments is significant. Current and potential applications of virtual reality technology address various neuro-rehabilitation issues. Vartual reality technology also allows the development of low-cost training environments consistent with a client's home environment furthermore, virtual environments are adaptable and can afford patients the opportunity to practice under a variety of simulated circumstances.

Key words: desensitization, simulated, cortical reorganization.

INTRODUCTION

Vestibular rehabilitation is an optimal intervention for individuals with vestibular disorders including benign paroxysmal positional vertigo (bppv) and the unilateral or bilateral vestibular hypofunction (reduced inner ear function on one or both sides) associated with ménière's disease, labyrinthitis, and vestibular neuritis.[1] vestibular rehabilitation has come a long way from cawthorne and cooksey exercises. The future for vestibular rehabilitation is exciting and will involve interaction with multiple disciplines.[2]the use of virtual reality (vr) to enhance vestibular rehabilitation is a relatively new concept. The novel aspect of using virtual reality in physical therapy vestibular intervention is that one can bring 'real' world situations instantaneously into the clinic.[3] through vr's capacity to allow the creation and control of dynamic 3- d, ecologically valid stimulus environments within which behavioral response can be recorded and measured, it offers clinical assessment and rehabilitation options not available with traditional methods.[4]

Virtual reality (vr) is a term that applies to computer simulated environments that can simulate places in the real world as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced haptic systems now include tactile information, generally known as force feedback, in rehabilitation.[5] origin of the term *"virtual reality"* can be traced back to the french playwright, poet, actor and director antonin artuad. In 1968, ivan sutherland, with the help of his student bob sproull created what is widely considered to be the first virtual reality augmented head mounted display.[6]

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Rationale behind the effectiveness of virtual reality training

1. Virtual reality has the capability to create an exercise environment where the intensity of practice and positive feedback can be consistently and systematically manipulated and enhanced to create the most appropriate, individualized motor learning programme.[6]
2. The specificity and frequency of feedback provided through virtual reality regarding knowledge of performance and the knowledge of results enhances motor learning skills.[6]
3. Virtual reality also induces cortical reorganization of the neural locomotor pathways .[7]
4. Virtual reality has been shown to be a suitable tool for cognitive rehabilitation because it allows a more comprehensive, ecologically valid, and controlled environment.[8]
5. Virtual environments may offer a way to systematically assess and treat executive functions and multitasking difficulties because virtual tasks are carried out within the context of the demands found in everyday tasks. [8]

APPLICATIONS OF VIRTUAL REALITY

The primary use of virtual reality in a therapeutic role is its application to various forms of exposure therapy, ranging from phobia treatments, to newer approaches to treating post traumatic stress disorders. A very basic virtual reality simulation with simple sight and sound models has been shown to be invaluable in phobia treatment (notable examples would be various zoophobias, and acrophobias). Much as in phobia treatment, exposure to the subject of the trauma or fear seems to lead to desensitization and a significant reduction in symptoms.[5]

Another field for the use of virtual reality is physical medicine and rehabilitation and occupational therapy. Virtual reality is being tested in upper and lower limb motor rehabilitation after stroke and spinal cord injuries, and also for cerebral palsy and other disabilities. Use of haptic devices and rehabilitation robots with virtual reality games to improve motivation during exercises is being done.[5]

Virtual reality is also being used to improve walking ability, balance, and endurance for an individual with multiple sclerosis. . Fulk, george d. Reported a case study in which a patient with multiple sclerosis underwent locomotor training using a virtual reality-based balance interventions for 2 days a week for 12 weeks. The client demonstrated improvements in gait speed, gait endurance, and balance post intervention and maintained the improvements at a 2-month follow up. An interesting aspect of the vr-based balance training and locomotor training interventions used in this case report was the cognitive demands during training that were reported by the client. During both of these interventions, the client would often comment on how hard she had to think about how she was moving. For example, while performing locomotor training the client would state that she never thought about how she walked before. During therapy she had to concentrate on how she moved her legs and trunk much more than she had ever done previously. She stated that this aspect of the training was almost as challenging as the physical demands.[9]

A multitude of causes lead to gait disability including stroke. Nigel w. Tierney et al. Described an innovative approach to gait rehabilitation via a system that combines the use of traditional and advanced rehabilitation techniques with a virtual reality (vr) training environment. The vr- gait system developed consisted of vr software that generated and displayed a dynamic urban environment on a large high definition television mounted in front of a treadmill. The treadmill was paired with an overhead suspension device that can provide a patient with partial weight support. Inertial tracking was used to actively monitor a patient's posture during a training session and prompt auditory cues that encouraged a patient to maintain correct walking posture. Improved gait rehabilitation was accomplished using a vr environment composed of widely available, relatively inexpensive, and unobtrusive hardware components.[10]

Fung, et al., performed studies on gait training for stroke patients by using a treadmill mounted on a 6-degree-of-freedom motion platform with a

motion-coupled vr environment. The six degree-of-freedom system provided the unique feature of simulated turning within the environment. This system also provided auditory and visual cues as positive/negative feedback. Subjects were required to wear 3d stereo glasses to visualize the virtual environment. Test results from this project demonstrated improved gait speed with training[10]. The application of virtual reality for use with persons with vestibular disorders is significant.

Whitney susan et al designed a virtual reality device, a balance near automatic virtual environment (knave), to determine the effect of a moving visual scene in persons with and without vestibular pathology. The postural sway of 2 patients and 3 controls were compared. Persons were asked to stand while viewing a sinusoidal waveform on a force plate. Postural sway was increased in both young and older adults in the immersive virtual environment. With continuous training balance improved to a significant extent.[11]

Tracy and lathan investigated the relationship between motor tasks and participants' spatial abilities by training participants within a vr based simulator and then observing their ability to transfer training from the simulator to the real world. The study demonstrated that subjects with lower spatial abilities achieved significant positive transfer from a simulator based training task to a similar real world robotic operation task.[12]

Virtual reality in telerehabilitation is a method used first in the training of musculoskeletal patients using asynchronous patient data uploading, and an internet video link. Subsequently, therapists using virtual reality-based telerehabilitation prescribe exercise routines via the web which are then accessed and executed by patients through a web browser. Therapists then monitor the patient's progress via the web and modify the therapy asynchronously without real-time interaction or training.[13]

Virtual environments have been used as an intervention tool to improve performance in comparable real-life settings. For example, teenagers with severe learning disabilities who practiced shopping in a virtual supermarket were able to shop more quickly in a real supermarket than those who used other, non supermarket virtual environments.[8]

Despite intensive and costly rehabilitation, the participation in everyday life of people after stroke is restricted during rehabilitation, there appears to be insufficient training of instrumental activities of daily living (iadls) such as shopping, use of transportation, and cooking because they are often time-consuming and technically difficult to implement. In addition, persisting impairments in motor, sensory, and cognitive abilities may affect the person's ability to return to his or her premorbid activities. Virtual reality programmed could be used as a novel intervention tool that will allow repetitive training of real- life tasks to improve multitasking while the person is still in a rehabilitation program. In a study by rand et al poststroke patients were taken and were provided with a virtual reality environment that consisted of a vmall – a virtual supermarket that encourages planning, multitasking, and problem solving while practicing an everyday shopping task . The products had to be virtually selected and placed in a shopping cart using upper-extremity movements. Participants showed improved performance in the real world after training in a virtual environment.[8]

NEED FOR FUTURE ADVANCES IN VIRTUAL REALITY TRAINING

The implementation of visual obstacles within the vr environment along with sensors to track the leg motion is another avenue of possible future extension. While the use of a simulated environment in rehabilitation is mainly a treatment tool, it also will aid in medical decision making in patient progress and prognosis. When the system is fully developed it can be made intelligent, taking into account the patient's abilities in terms of distance, speed, weight bearing, and movement responses so that the decision of when and how much to advance the program's difficulty is automatic and based on patient performance parameters.[13]

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